Effect of Demonetization, GST and Covid-19 Outbreak on Overall Technical Efficiency and Total Factor Productivity Growth of Indian Automobile Industry

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1. INTRODUCTION

The Indian automobile sector is one of the most competitive sectors in the world and plays an important role in economic growth with high employment output. The major factors that affect the economic growth of any country are capital formation, natural resources, human resources, and technology. The growth of an economy is also affected by efficiency and productivity as these are the two most significant economic measures that describe the comparative performance of manufacturing units. Therefore, an examination of industry performance through productivity and efficiency is mandatory.

The most significant indices of competition are the productivity of labor and capital. Global auto players started their operations in India during the late nineties, resulting in technology upgrades, product range expansion, new market growth, cost-cutting. Thus, the Indian auto industry is observing an increase in product quality, efficiency, and productivity along with an increase in its production efficiency. For the growth of this sector, the Government of India plans to set up an incubation center to assist start-ups in electric vehicles in the coming years.

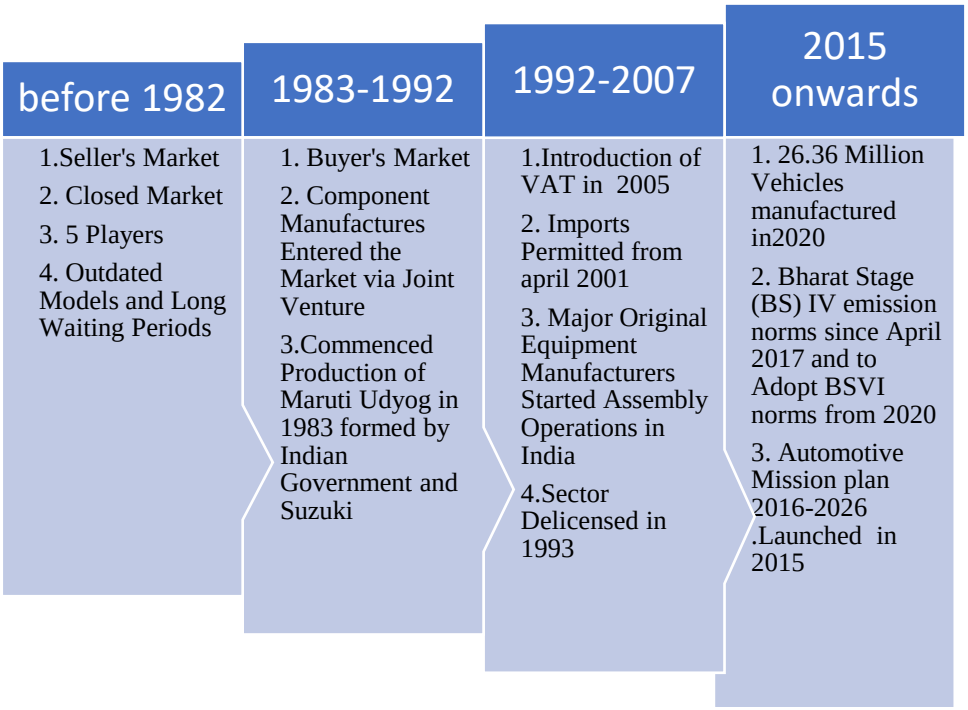
Within the span of four years from 2016 to 2020, the Indian economy has suffered three significant macro-economic shocks including post-demonetization, Goods and Service Tax implementation, and the covid-19 pandemic which has halted the growth trajectory of the country. The phase of post-demonetization is contemplated from 9th November 2016 to 30th June 2017, the GST from 1st July 2017 to 29th January 2020 and, the covid-19 from 30th January 2020 to continuing. Goods and Service Tax implementation and Demonetization are two current major economic amends that India has initiated to bolster the economy but the covid-19 outbreak has shaken the entire world economies.

The effect of these three macro-economic shocks is found grievous. It is necessary to understand the chronology of these phases to establish the fact that the current economic downfall is not just about the covid -19 outbreak but was started since post demonetization. That's why it is important to study the major impacts of these three macro-economic shocks and outline the lack of policy actions that have led the problem to magnify in the economy. Also, the researcher has tried to found the reality that all three have been instrumental in influencing the efficiency and productivity automobile industry in India. Also, the center and state must work together to build a robust infrastructure to face any new deadly virus like covid-19 in near future and to get the economy back on track.

An Outlook of the Auto sector

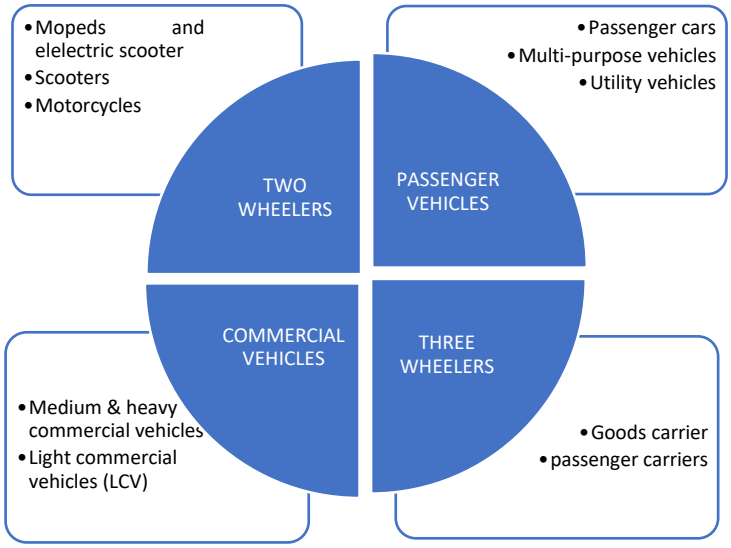
The auto market is considered one of the biggest sectors in the global market by striving in the development of innovative products, technology, and supply chains that become leaders in process and product technologies in the production industry (Mishra & Chauhan, 2018) Which boost economic development and contributes significantly to the overall industrial development in the country (Jothi & Kalaivani,2015).

Evolution of Indian Automobile Sector


before 1982
1.Seller's Market
2. Closed Market
3. 5 Players
4. Outdated Models and Long Waiting Periods
1983-1992
1. Buyer's Market
2. Component Manufactures Entered the Market via Joint Venture
3.Commenced Production of Maruti Udyog in 1983 formed by Indian Government and Suzuki
1992-2007
1.Introduction of VAT in 2005
2. Imports Permitted from april 2001
3. Major Original Equipment Manufacturers Started Assembly Operations in India
4.Sector Delicensed in 1993
2015 onwards
1. 26.36 Million Vehicles manufactured in2020
2. Bharat Stage (BS) IV emission norms since April 2017 and to Adopt BSVI norms from 2020
3. Automotive Mission plan 2016-2026 .Launched in 2015

The Indian automobile industry has come a long way from the embryonic stage to its present dynamic form in the 1940s. The industry has witnessed the production of 4000 vehicles in 1950 and marked a new journey in 1991 due to economic liberalization and 100% FDI permitted by the automatic route. Production thereafter increased from 1.5 million in 1993-94 to 10 million in 2006–07(Ranawat, 2009). In 2019, the rank of India was 4th in the manufacture of cars and 7th in the manufacturer of commercial vehicles in the world with overall vehicle exports reached 4.77million grew at a 6.94% CAGR between FY16-20(IBEF2020, p.3). The auto industry increased domestic production at 2.36%CAGR and domestic sales at 1.29% CAGR during 2016-2020 (IBEF2020, p.9) Which predicts the future growth of the industry through newly adopted strategies such as capacity addition, electric vehicles, new model launches, etc. (IBEF2020, p.15-16). Currently, the auto sector manufactures a comprehensive set of automobile and auto components for both foreign and domestic markets (Ranawat, 2009).

Structure of Indian Automobile Industry



The auto industry has appeared as a 'sunrise sector' (Krishnaveni & Vidya 2015) which is considered a vigorous sector in the Indian economy and contributes 7.1% share to GDP (Tomar & Soni,2016). Contemporary government action such as Make in India, National Electric Mobility Mission Plan 2020, and Automotive Mission Plan 2026 (Nagpal et al.,2019; Sur & Nandy,2018) can transform India into an automobile production hub and move in the appropriate direction (Sur & Nandy,2018). Indian market study highlights that there is a massive demand-supply difference between quality products (Tomar & Soni,2016), trained manpower, strong technological capability, and growing earning power at competitive prices (Shinde & Dubey, 2011) Which give a base for foreign players to occupy the Indian auto sector (Tomar & Soni,2016).

Technical Efficiency and Productivity

Technical efficiency and productivity are considered as the indicator of performance for a firm. These terms measure the performance of any firm in terms of conversion of the available resources to produce the output. Technical efficiency and productivity are used as synonyms in general. Even a lot of existing studies consider it the same and use it interchangeably. But there is a difference between the two terms which is crystallized by the following discussion. Productivity can be defined in terms of the conversion of inputs into outputs in a production process/service delivery. In other words, productivity is the ratio of output to the input used. Every business tries to maximize the output for a given level of input or tries to minimize the input to achieve a target level of output. In this sense, productivity is an absolute term. Efficiency can be defined in terms of maximization of output for a given bundle of input or minimization of

input for a given level of output when compared with the best performing benchmark in the industry. In this sense, efficiency is a relative term.

PRODUCTIVITY = OUTPUT/ INPUT

Hence, productivity is the ratio of total output to the total input (Ray, 2004). Productivity is also called Total Factor Productivity (TFP).

TECHNICAL EFFICIENCY = ACTUAL OUTPUT /MAXIMUM PRODUCIBLE OUTPUT

Hence, efficiency is the ratio of actual output with the benchmark output (maximum producible output) with a given level of input (Ray, 2004). Efficiency is also referred to as the overall technical efficiency. This measure of technical efficiency is output-oriented where we try to maximize the output for a given level of input. A productive firm may or may not be efficient. A firm may be productive and inefficient simultaneously.

2. REVIEW OF LITERATURE

A review of the existing literature is necessary to explore and become familiar with the events of interest and to gain an advantage from an earlier scholar to examine gaps to make research time meaningful. Several studies have been conducted related to the performance analysis of the Indian automobile industry.

Selvi and Vijayakumar (2007) measured the performance of specified automobile companies in India during 1991-92 to 2003-04. The researcher used the Economic Value-Added Approach and concluded that there was a significant and increasing trend in Economic Value Added of selected companies which described there was a positive trend to improve their firm values.

Saranga (2009) investigated the operational efficiency and its determinants in the auto components sector in India using data envelopment analysis. Various operational inefficiencies were decomposed into scale, technical, and input mix efficiencies, which found that most inefficient companies were operating in low returns in the scale region and reflected probable savings by standard input targets. Also, it explored the root cause of inefficiencies and found that substitution of labor for capital can be the cause of various types of inefficiencies, including input mix inefficiencies.

Mazumder and Adhikary (2010) studied the firm-specific time-invariant technical efficiency of the auto sector in India. The researcher used a stochastic production frontier during 2004-2006 and highlighted that from its inception there was a negative association between firm age and technical efficiency level. However, the firm's market share and automation degree were revealed to be positively related to the technical efficiency level. It was later indicated that the technology used was linear homogeneous in the Indian automobile industry.

Shinde and Dubey (2011) studied the performance, trends, and growth of Indian automobile firms during 2005-2010. The research analysis showed that the passenger car segment was dominated by the share of Maruti Suzuki, commercial vehicles by Tata Motors, two-wheelers by Hero Honda Motors, three-wheelers by Bajaj Auto, and also highlighted that trends and growth of the Indian automobile sector were growing at a faster rate.

Dharmaraj and Kathirvel (2012) investigated the effect of pre and post FDI on the financial performance of the Indian Auto Sector using profitability, efficiency, liquidity, and solvency ratios during 1999-2012. It was concluded that profitability and efficiency ratios highlighted increasing trends while there were slight changes in liquidity ratios during post-FDI. The overall outcomes stated that FDI led to a positive influence on the financial performance of the Indian auto sector.

Ray (2012) studied to assess the influence of various factors that influence the capacity utilization of the automobile industry in India. The researcher used an econometric model and results revealed that Capacity utilization has improved but capacity increases more speedily than production growth. The result suggested that the import penetration ratio and coefficient of export-concentration variables were inverse therefore indicated that capacity utilization was comparatively low in companies related to the industry characterized by import penetration and high export concentration. It was also observed that there was a positive and significant correlation between capacity utilization and size, between capacity utilization and market share.

Ray (2012) measured the performance regarding various financial measures, production trends, export trends, and sales trends of the automobile industry in India. The researcher used financial indicators, as well as ratio analysis and results, found that the Indian automobile industry was going by unsettled stages characterized by huge liquidity crunch, debt burden, and low utilization of assets. The study also suggests that the industry is to improve capital efficiency, labor productivity, and labor flexibility.

Dhole (2013) examined the relationship between the price movement of shares and company performance of the auto sector in India using fundamental analysis of four companies including company, industry, and economic analysis. The outcomes of the study highlighted that Speculative news had a significant influence on the price movement of shares for a very short period. Therefore, the potential investor should opt for fundamental analysis for better results.

Kumar and Bhatia (2014) compared the financial performance of Maruti Suzuki and Tata Motors after the liberalization policy. The study used ratio analysis and found that there was not considerably dissimilar between the two firms in meeting their shortened liquidity, profitability, and solvency. It was also found that both the companies were dissimilar in meeting their longstanding solvency and longstanding obligations. It was further showed that the comparative financial strength between two companies is based on efficient use of assets, liquidity, and profitability.

Srivastava (2014) analyzed the trends, growth, and performance of specified companies in the Indian automobile industry. The fundamental analysis revealed that the performance of the auto sector was directly related to economic trends, the technical analysis highlighted that there was an association between the automobile industry and the BSE index indicating the prediction of each other's movements, and the volatility analysis Mahindra & Mahindra is strongly related to Auto Index compared to Maruti Suzuki India Limited and Tata Motors Limited.

Jothi and Kalaivani (2015) analyzed and compared profitability, liquidity, solvency ratios of the Toyota and Honda Automobile industry in India. The researcher used ratio analysis and found that both companies have comfortable short-term liquidity positions. From the profitability point of view, Honda company has a higher earning capacity. Also, summarized that both Toyota and Honda have sound financial management practice.

Pal (2015) aimed to reduce the number of financial ratios that may be skilled to illustrate the real economic situation and examining individual factors that influence the profitability of the automobile sector in India. The researcher used factor analysis as well as multiple regression. Factor analysis was applied to 36 audited financial ratios classified into 7 categories. Multiple regression analysis found that 3 specific factors i.e., working capital to total assets, dividend payout ratio to cash profit, and inventory turnover ratio have a significant and positive impact on the profitability factor of the Indian automobile industry.

Krishnaveni and Vidya (2015) studied category-wise sales, exports, and production of selected firms of the auto sector in India using SWOT analysis from 2004 to 2013. The analysis stated that the overall sales and production of the Indian auto sector increased and the export performance of the firms documented steady growth while the exports of commercial vehicles and three-wheelers declined.

Kumar and Kaur (2016) tested the profitability and size of the automobile industry in India. The firm’s size was represented by net assets and total sales turnover while for profitability the ratio of net profit to net assets plus working capital and ratio of net profit to total sales turnover had been used. The researcher used a linear regression model from 1998 to 2014 and research results found that time series analysis revealed a positive and significant association while cross-section analysis revealed no relationship between profitability and firm size.

Arumugam et al. (2016) aimed to investigate the profitability and examined the influence of numerous determinants on the profitability of the auto sector in India. The study used stepwise multiple regression and multiple correlation analysis. Research results show that the profitability of the auto sector was eminently dependent on the operating ratio and add to the deviation in return on sales.

Shajar and Farooqi (2016) investigated the influence of working capital management practices on the profitability of specified firms such as Tata Motors, Mahindra & Mahindra, and Maruti Suzuki of Indian automobile companies during 2005–2014. The researcher used the correlation

coefficient to examine the linear relationship between current ratio (CR), inventory turnover ratio (ITR), debtor's turnover ratio (DR), and return on capital employed (ROCE) while regression analysis was employed to investigate the impact of CR, ITR, DR on the ROCE. The results of the study found that the CR and ITR were insignificant while the DR was significant for profitability.

Gupta and Vardhan (2016) Studied the overall equipment effectiveness (OEE) of the machine, plant manufacturing capabilities, and manufacturing cost by total productive maintenance (TPM) of the Indian tractor manufacturing industry. The results of the study showed that OEE and productivity increased, reduced production costs, doubled sales revenue, and tripled profits. It has also shown the intangible and tangible benefits of TPM implementation.

Babu and Chalam (2016) investigated the capital structure and its variables of the Indian auto sector using panel data analysis. The researcher used fixed regression effects and insinuated that firms use pecking order theory for their long-term financial decision. Out of seven factors, only one was significant (profitability), and the remaining six variables, such as; growth, tangibility, size, risk, liquidity, and non-debt tax shield were insignificant and do not play a role in determining leverage.

Baby and Latha (2016) assessed the profitability, growth, and size of the selected Indian automobile industry from 2004 to 2014. The findings showed that segments such as motorcycles, HCVs and LCVs, and tractors were in good condition with steady growth except for HMT Ltd. While size and growth of three-wheeler, auto cars, and scooters segment were considered deficient and firms have achieved inverse growth regarding profitability. Whereas differentiating the profitability position of the firms, only Atul Auto Limited, International Tractors Limited, and Tractor and Farm Equipment Limited were revealed to be profitable while other companies suffered severe losses during the studied period.

Mathur and Agarwal (2016) investigated the financial position and compared the financial performance through inter and intra-firm analysis of Maruti Suzuki and Tata Motors in the automobile industry in India. The researcher used ratio analysis and stated that net sales, gross profit, net profit, and earnings per share of Maruti Suzuki were higher than that of Tata Motors. In nutshell, Maruti Suzuki was outperforming Tata Motors.

Tomar and Soni (2016) investigated the performance of the injection molding unit of the Indian automobile sector using overall equipment effectiveness (OEE). Also, identified the major productivity losses in terms of quality loss, downtime, and speed loss. The researcher indicated that the average percentage of OEE of the molding segment is marginally lower than global standards. The OEE quality rate and performance factors were described as more satisfactory while the availability factor was much lower due to major changes over time and no planning. Also, factors of loss of productivity were identified and eliminated.

Hiran (2016) investigated the effect of liquidity ratio and leverage ratio on the profitability of the Indian auto sector. The research used ANOVA, correlation, regression, and descriptive statistics. The outcomes of the research highlighted that the association between the inventory turnover ratio and operating profit was negative. Also, the relationship between net profit and quick ratio with operating profit was positive, while the current ratio has shown an inverse relationship with net profit. Furthermore, the researchers found that both operational and financial leverage in addition to combined leverage showed a negative and significant relationship with the profitability of the automobile industry in India.

Gupta and Sur (2016) investigated the financial and business risks of eleven automobile companies from the list of top one thousand Indian companies during the period 2001-2011. The researcher used Ginni's coefficient of concentration for measuring risks. The findings of the study revealed that the relationship between business risks and their components (CPR, CSR, LR) was insignificant while there was a strong positive relationship between business risks and financial risks.

Vemula (2017) examined the impact as well as the relationship between corporate governance and profitability using correlation and ordinary least square model in Indian automobile firms. The researcher found that there was a significant and positive linkage between profitability and the director's remuneration while the profitability and number of audit members were negatively correlated. It was also found that non-executive directors, the board size, and board meetings were insignificantly associated with the profitability.

Shajar (2017) studied the impact as well as the relationship between working management practices on the profitability of 26 automobile firms listed on the Bombay Stock Exchange during 2007-2016. The study insinuated that payables, receivables, CCC, and ICP created an inverse and significant influence on the value of the company (TOBIN-Q) and profitability (ROA) whereas growth and leverage positively impact profitability. And, the fixed effect regression test showed that there was a huge intensity of association between working capital management and profitability.

Abey and Velmurugan (2018) analyzed the factors influencing the profitability of the automobile sector in India. The research used correlation and Multiple Regression. The results of the study stated that growth in sales, leverage, asset turnover ratio, company size, index of industrial and production were the factors that determined the profitability of firms. Further, it was found out that the survival of the firm depends on the industrial situation that prevails in a country. Therefore, the government needs to provide financial and infrastructure support for the survival of firms.

Kumar and Ram (2018) investigated the financial performance and their influence on the profitability and liquidity disposition of the auto sector in India from 2013-14 to 2017-18. The researcher used ratio analysis and revealed that firms' profitability was significantly affected by

the firm's growth, the firm's liquidity position, debt-equity ratio, inventory turnover ratio, and average payback period.

Jaisinghani *et al.* (2018) investigated the association between capital expenditure intensity with firm performance in the Indian automobile sector. The researcher used a dynamic panel regression technique and found an inverse and persistent relationship between firm performance and capital expenditure intensity. Also, was shown a possible U-shape relationship between firm performance and capital expenditure intensity.

Sur and Nandy (2018) compared the technical efficiency and its determinants of domestic firms (DFs) and foreign firms (FFs) in the automobile industry in India during 2001–2014. Also analyzed the transmission of overabundance from DFs to FFs regarding information effects, competition, and performance. The study employed stochastic frontier analysis and revealed the high technical efficiency of FFs over DFs. It was also found that both FFs and DFs were relatively more efficient. And, DFs has not benefited from export activities, mainly because of their inward-orientation. Also, the spillover effect only prevails through the performance effect. Information and competition influence are not important mediums for the transmission of overabundance from FFs to DFs.

Sahoo and Rath (2018) investigated the source of inefficiency, efficiency change, and productivity growth of selected two-wheelers, commercial vehicles, and passenger vehicles, firms in the Indian auto sector. The data envelopment analysis approach was used to investigate efficiency change, productivity growth, and source of inefficiency. The findings of the study observed that the productive increase of the auto sector was positive during 2009-2015. However, the researcher reported that commercial vehicles were more efficient than two-wheeler companies and passenger vehicles. Also, it was found that in about fifty percent of firms, excess input was the cause of inefficiency.

Mishra and Chauhan (2018) investigated the efficiency, profitability, cash flow position, growth rate, and market capitalization of Tata Motors and Maruti Suzuki. Also, it analyzed the performance of the selected company concerning the Porter 5S model. The researcher used ratio analysis and highlighted that Tata Motors must efficiently control its liquid assets and current assets to pay its current obligations so that the company’s creditors feel secure about their repayments amount by the company. In nutshell, the researcher concluded that Maruti Suzuki is better than TATA Motors.

Nagpal et al. (2019) studied the financial performance and growth of the top five most revenue-generated companies in the Indian automobile industry using the E-I-C framework from 2013-2018. The researcher concluded that all the factors indicate a positive significant influence on the long-term investment decision. The company analysis disclosed the positive result in the case of Tata Motors and Mahindra & Mahindra and negative in the case of SML Isuzu, Maruti Suzuki, and Force Motors due to the increase or decrease in their intrinsic value compared to their market value.

Agwan (2019) studied the influence of capital structure on the profitability of four specified companies such as Bajaj Auto Limited, Hero Motors Limited, TVS Auto Limited, and Atul Auto Limited in the Indian automobile industry from 2011-2016. The study used financial tools such as ratio analysis and statistical tools like correlation and regression analysis, Karl Pearson's coefficient, average, ANOVA. The findings of the study showed that the growth and liquidity of the companies led to a significant impact on the debt-equity ratio. Also, it was concluded that there was a significant and positive linkage between capital structure and profitability.

Shukla (2019) Studied the impact of a company and corporate social responsibility (CRS) expenditure on the financial performance of selected firms in the auto sector in India. The researcher used regression analysis and found that there was a positive and significant linkage between CSR and financial performance. Furthermore, it is revealed that spending on CSR firms increased public confidence and created a positive public perception that positively impacts market share and consumer loyalty.

Vadivel *et al.* (2019) explored the impact as well as the linkage between intellectual capital and financial performance of Indian auto sector firms during 2009-2018 using correlation and regression. The overall outcomes revealed that a rise in the price of the entire sub-factor of the revised value-added intellectual coefficient, excluding relational capital, and capital employed inhibited the rise in the price of RONW, ROE, and ROA. It was discovered that relational capital was not associated with firm performance.

Kumar (2019) investigated the influence of capital structure on the profitability of the specified firms such as Mahindra & Mahindra Ltd. and Tata Motors Ltd. of the auto sector in India employing financial ratios such as ROCE, ROA, EPS, ROE, and Net profit margin. The researcher revealed that a lack of association between profitability and leverage, liquidity and business risk. It was found that the debt-equity ratio between two companies was below the ideal ratio “2”. It was suggested that selected companies should make attempts to reduce operating costs through the restructuring of loans and interest payments, better asset utilization, and other strategic measures to improve profitability.

Arumugam and Kumar (2020) examined the financial performance of the selected Indian tire sector. The study was based on secondary sources of data and revealed that the vital factors influencing the performance of the tire industry were fluctuations in fuel prices. Tire demand depends on many external factors such as economic development and infrastructure development in the country. The tire industry was also directly affected by vehicle performance Manufacturing sector which in turn was dependent on overall economic development.

Gulati (2020) investigated the total factor productivity (TFP) and its decomposed components of eight-passenger bus companies using sequential Malmquist-Luenberger productivity index (SMLPI) during 2011–2016. The TFP growth analysis revealed that in Indian metropolitan cities, public bus transit systems experienced gentle productivity conditions that were responsible for efficiency losses. Also, it was revealed that four bus companies experienced gains from

productivity while Pune Mahamandal bus company disclosed to be the most innovative company.

Kamran (2020) Investigated the growth and financial performance of auto firms in India. Also, the researcher recommends measures to improve the performance of Indian auto sector firms. It was based on secondary sources that revealed the liquidity ratio had an effective strong correlation. This leads to amazing stock administration and increases greater liquidity power for conversion companies. Therefore, research proved that some heavy adjustments were made to meet their liabilities.

Kour *et al.* (2020) investigated the influence of green practices on the financial performance of selected automobile companies in India. The study used the structural equation model and observed that Eco-design, Integrated Environmental Management, Green Marketing, and Technology Integration led to a positive significance while Customer Oriented and Pollution Prevent were observed to lead to an insignificant influence on the financial performance of Indian companies.

3.RESEARCH GAP

According to a review of the existing literature, most studies are conducted upon measuring the financial performance based on profitability and market growth, which considers certain parameters of liquidity, leverage, working capital, trends, capital structure, and various types of financial ratios. There are only a few studies that consider the Data Envelopment Analysis (DEA) technique of a non-parametric frontier approach to measure the efficiency and productivity of the Indian automobile industry. In short, the number of studies conducted is not sufficient if we consider a large number of firms in the auto sector in India. Therefore, a wide gap can be bridged by studying the performance of the auto sector in India with the help of modern techniques such as Data Envelopment Analysis (DEA) to provide new and concurrent insights. The study under consideration will bridge this gap by studying the performance of the auto sector in India with the help of the Data Envelopment Analysis (DEA) of the non-parametric frontier approach. No study shows the impact of all three Demonetization (November 8, 2016), Goods and Services Tax (GST, July 1, 2017), and Covid-19 outbreak on the efficiency and productivity of the Indian automobile industry.

4. SCOPE AND RELEVANCE OF STUDY

The auto sector is one of the major automobilists promoting the economic development of the region. To fulfill this objective, the firms have to be efficient and productive in their operation. The Indian auto sector has become globally competitive in today's era of liberalization, privatization, and globalization (LPG). Therefore, the survival of an enterprise depends on efficiency and productivity. The research will focus on both aspects of the efficiency and productivity of the Indian auto sector. Hence, the study will be beneficial to the management of these firms and the policymakers of the automobile industry. The study will take a reasonable

representative sample from all the automobile firms working presently throughout the country. The data will be for at least 10 years period. The analysis of this panel data under the study will provide an accurate and precise examination of the efficiency and productivity of the Indian automobile industry. In a nutshell, the study will assist in devising effective and efficient tactics to improve the working of automobile firms and to make them viable and self-sustained.

5.RESEARCH OBJECTIVES

The major objective of the research is to assess the performance of the Indian automobile industry with the following particular objectives as mentioned below.

- To measures the overall technical efficiency of the Indian automobile industry and give rank based on their performance.

- To examine the Total Factor Productivity (TFP) growth and its components among the Indian automobile industry.

- To analyze the effect of demonetization, GST, and COVID-19 outbreak on the overall technical efficiency and total factor productivity growth of the Indian automobile industry.

6. RESEARCH METHODOLOGY

The research methodology is the blueprint for conducting the research. It includes defining the problem of the study, framing of the hypothesis, research design, sampling methods, sample size, collection of data, tools, and techniques to analyze the data.

Research Design

Firstly, the study under consideration explores the existing literature in the related and similar field to define the various construct and to adopt sophisticated and modern techniques for doing research. The next step is to define the existing phenomena under consideration by collecting and analyzing the data. Hence, the study will be based on exploratory cum descriptive research design.

Sampling Techniques

This study will be based on purposive and random sampling techniques to select a representative sample from the given population. This technique satisfies the research required to select a sample according to the given circumstances.

Sample Size

This study would include a sample of selected companies in the Indian automobile industry.

Data Collection

The proposed research will be based on secondary data. The data will be collected from prowess, BSE website, audited annual reports of the selected companies, different financial websites and newspapers, journals, and other sources as per the requirement of the study.

Period of Study

The period of study will be of at least 10 years which is considered sufficient to conclude the study under consideration. The period of data may be increased as per the availability of the data.

Statistical Models and Techniques

There are two techniques available for the measurement of efficiency and productivity under the frontier method namely parametric and non-parametric approaches. A parametric technique such as the Stochastic Frontier Approach (SFA) and a non-parametric technique such as Data Envelopment Analysis (DEA) approach is properly employed and recommends for efficiency and productivity measurement. The present study will use the Data Envelopment Analysis (DEA) of the non-parametric frontier approach. There are two reasons for choosing the Data Envelopment Analysis (DEA). The first reason is the non-requirement of the assumption regarding production function and, the second reason is accepting the multiple inputs and multiple outputs for efficiency measurement. Data Envelopment Analysis (DEA) is a technique to analyze the efficiency of decision-making units (DMU) by comparing all the DMUs with the best performing DMUs. This technique is developed by Charnes et al. (1978) by expanding the initial work of Farrel (1957) for measuring efficiency. Various econometric techniques would be used according to the requirement at the time of the study.

7. PROPOSED CHAPTERS SCHEME

Following would be the proposed scheme of study:

Chapter I - Introduction

This chapter would include the clarification of the concept. Further, the research objective and significance of the study would also be discussed.

Chapter II - Review of literature

This chapter would provide a brief overview of the previously existing literature on measuring the performance of the Indian automobile industry.

Chapter III - Research methodology

This would include research design, type of data, and period of the study, data collection sources, and various statistical tools.

Chapter IV and V - Analysis and interpretation of data

Chapters 4 and 5 would discuss the analysis and interpretation of results to achieve the objectives.

Chapter VI - Conclusion and recommendation

This chapter will conclude the study and provide recommendations and scope for future research.

The above chapter scheme is tentative. Depending on the actual research work it may change in the course of the study.

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